THE HILL

By standing still, America will fall behind in the new era of computing

By Reps. Chaka Fattah (D-Pa.) and Randy Hultgren (R-Ill.)

Federal investment in high-performance computing research is critical to the competitiveness of the United States. Government agencies use some of the world's most powerful computers for a wide variety of crucial missions — everything from ensuring the integrity of our nuclear arsenal to performing fundamental research into the links between genetics and disease. In addition, collaboration between the government, industry and academia makes it possible for all sectors of our society to reap the benefits of cutting-edge computing technologies.

That's why we support the reauthorization of the Department of Energy High-End Computing Revitalization Act of 2004. This bill will improve high-end computing research at the Department of Energy and strengthen government/industry partnerships aimed at producing the next generation of computing technologies.

Reaffirming our commitment to these investments is more critical than ever because the evolution of computers is at a turning point. A new era of technology is coming — the era of cognitive systems. Computer scientists tell us that the latest advances in software and mathematics make it possible to create machines that sense, learn and, in some ways, think. These machines will help people and organizations penetrate complexity and make better decisions. There are huge ramifications for national competitiveness.

At the same time, some of the key chip and computing system technologies that we have relied on over the past decades to drive performance improvements have hit a wall. The pace of innovation is slowing and, unless our scientists and engineers produce breakthroughs, progress will stagnate. We need innovations that produce so-called "exascale" computers capable of crunching data 1,000 times faster than today's fastest machines.

Already, some of the scientists in the national laboratories are running into the limits of computing performance. And soon, businesses will face similar challenges, largely because data is growing at an unprecedented rate. The data is coming from the technologies that mark our age: mobile phones, cloud computing, social networks and what we call the "Internet of things," including everything from your car to your refrigerator to the thousands of texts your son or daughter sends each month. Imagine the data volumes generated by just two popular sources: the 2 billion videos watched daily on YouTube and the 293 billion emails sent every single day. As much data is generated in two days in 2013 as in all of human history prior to 2003.

Having lots of data should be a good thing. It can help people and organizations understand how the world really works, so they can make it work better. But if you don't have the right technology tools to deal with the deluge of data, it can hurt rather than help. It adds to the complexity, rather than helping us master it.

In order to put data to use, we need computers that work more like the human brain works. We have to be able to perform huge volumes of calculations while consuming just a trickle of energy. But, to create computers that work more like the brain, we have to understand more deeply how the brain itself works.

Congress, in a bipartisan show of support, voted to direct the White House Office of Science and Technology Policy to establish the Interagency Working Group on Neuroscience (IWGN). The work of the IWGN is to establish a coordinated strategy with federal agencies to significantly increase the level of investment in neuroscience. The IWGN will press forward to explore the complexity of how the brain works and further address brain development, disease, injury and cognitive function.

The medical implications of having a computerized simulation of the human brain are tremendous. Researchers at IBM and Lawrence Livermore National Lab actually have a working computer simulation of the human heart. The next iteration of this would be having a working system that can understand how the heart connects to the brain and the rest of the body. Our current supercomputer technology just cannot do that type of work. Not having U.S. researchers focused on applying a system like this to research brain disorders like autism or Alzheimer's would be a tremendous loss.

America holds numerous advantages in technology, innovation and science. It is the world's wealthiest nation and remains its only superpower. However, we can no longer take our leadership for granted. Substantial foreign investment in supercomputing has enabled Japan and Europe, and recently China, to take and retain top spots in the Top 500 world rankings of the fastest supercomputers. We risk losing ground by standing still.

These challenges aren't just technological. The United States faces a daunting challenge as it strives to compete globally in science, technology, engineering and mathematics related industries. American students are being outperformed on international science. Creating an effective pipeline for the next generation of young scientists and engineers will help our nation win the future in technology and innovation.

To help America stay globally competitive, the federal government must make substantial investments in scientific research. This isn't a time for paring back. We have to be ambitious and bold. We must become the leader in the new era of computing — the cognitive era — just like we have led since the 1940s, when computers began putting their mark on every aspect of business and society.

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